

DON'T LET POLLUTION LEAVE HOME

Overview: In this activity, students will use a model of the sanitary sewage system and the storm drain system to discover where pollutants end up when they are poured down a sink or a storm drain. They will also study how these pollutants harm wildlife.

Content Standards Correlations: Science, p.308

Grades: 3-6, K-2 with modifications

Key Concepts: There are many ways that pollution can enter waterways and groundwater. When these pollutants eventually make their way to the Bay and enter food chains they may be harmful to wildlife.

Objectives:

Students will be able to:

- identify ways that hazardous household products can enter water systems
- explain the difference between the sanitary sewer system and the storm drain system
- name one way they can prevent hazardous products from entering the waterways of the Bay

Materials:

Provided by the Refuge:

- 1 sink & storm drain model
- 1 set of pollution role cards & pollution products (attached)
- pollution (assorted beans)
- food pyramid poster
- 1 story book (K-2)
- food pyramid puppets:
 - phytoplankton,
 - 8 zooplankton,
 - 1 clam,
 - 1 mussel,
 - 2 crabs,
 - 2 clapper rails,
 - 1 peregrine falcon

TIMELINE FOR CONDUCTING THIS ACTIVITY

Recommended Time: 30 minutes

Introduction (3 minutes)

- discuss pollution poured down sinks and storm drains

Sink and Storm Drain Model (12 minutes)

- **Grades 3-6:** divide the students into pairs and hand each pair a pollution role card and their pollution product; have each pair read their card and pour their pollutant either down the sink or the storm drain
- **Grades K-2:** demonstrate a pollutant going down the sink and one going down the storm drain by reading the story on the back of the picture card

Discussion (3 minutes)

- discuss the different paths they take down the storm drain

Toxic Food Pyramid (12 minutes)

- discuss the Bay food pyramid poster
- hand out puppets (one per student)
- have puppets feed on each other in the correct order
- “dissect” the peregrine falcon puppet with the group and discuss why pollution accumulates in the top consumers in a food pyramid

HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

What are the Refuge's resources?

- significant wildlife habitat
- endangered species
- migratory birds

What makes it necessary to manage the resources?

- Pollution dumped down storm drains enters the slough and mudflats and travels through the food chain, harming wildlife.

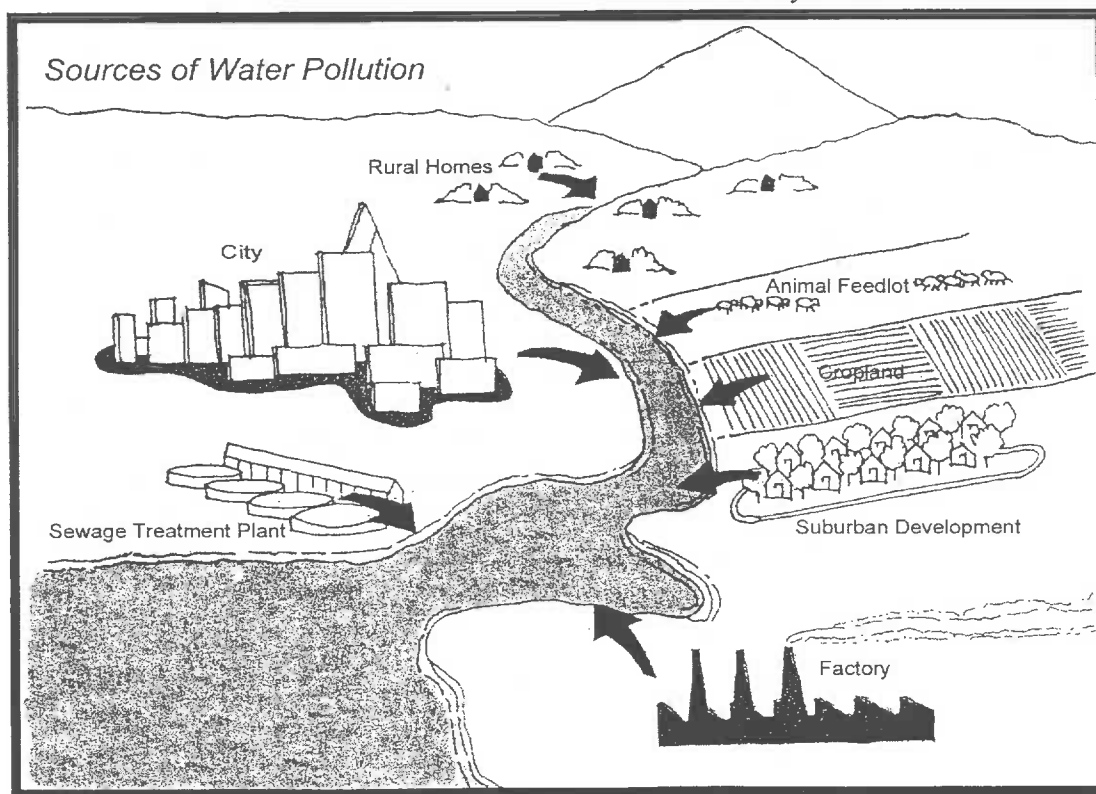
What can students do to help?

Refuge staff study pollutants found in the Bay to see how they affect wildlife, but we need your help.

- Never dump anything down storm drains
- Label storm drains with warnings
- Use products in the home that do not contain heavy metals

SUPPORTING INFORMATION ABOUT THIS ACTIVITY

- **Storm drains** are not connected to the sanitary sewer system that transports wastewater from our sinks and toilets to the water pollution control plants. Instead, several storm drains empty into large pipes that flow directly into our creeks and rivers.
 - Because of this, *storm drains* have the potential to pollute our waterways.
 - A major source of water pollution is caused by the combined effect of pollutants that are dumped by individuals around the home and garden.
 - Many items at home (motor oil, paint, cleaning products, fertilizers, etc.) contain powerful substances that can cause pollution if they are not recycled or disposed of properly. If these products are carelessly washed into neighborhood streets and gutters, or soak into the ground from lawn watering, they can eventually reach waterways and cause environmental damage.
 - Anything other than rain that is dumped into a storm drain can eventually pollute a creek, river, slough, tidal marsh, bay or the ocean.
 - Estuaries, the part of a waterway where the fresh water from a river or creek meets the salt water of the ocean's tides, are particularly sensitive to pollutants because they are abundant with plant and animal life, often used for breeding by aquatic animals, and provide an environment where pollutants can easily collect.
- Pollution, often caused by the improper disposal of products used in and around the home, can damage life in waterways long after and far from where it was released.
- **Sinks and toilets** are connected to drains that transport wastewater to water pollution control plants. The treated water is then discharged into a natural waterway. How is it possible that hazardous materials poured down a sink or toilet end up in our waterways when anything put down an inside drain goes into the sanitary sewer system which flows to a water pollution control plant?
 - The explanation is simple. When wastewater reaches the water pollution control plant, it goes through several different cleaning processes before the treated water is discharged into a large body of water, such as the San Francisco Bay.
 - Although the water is treated and much cleaner than it was before processing, it is still too costly to remove all traces of toxic substances. Therefore a tiny portion of the household product (usually a heavy metal) escapes into the waterway.



HOW TO LEAD THIS ACTIVITY BY FOLLOWING THE "DO, READ, ASK" TEACHING FORMAT

Grades K-6

Introduction: (3 minutes)

Do

Gather the students around the sink and storm drain model.

Read

"We are going to learn how pollutants enter the Bay."

Ask

? Are there any sources of pollution in your homes or yards? Can you name some of these products? (Students' responses will vary. Many cleaning, car, and garden products contain hazardous elements which can be harmful to humans and wildlife. For example: Bleach, motor oil, furniture polish, oven cleaner, fertilizer, antifreeze, etc.)

Read

"When pollutants are spilled outside, it is possible for them to be washed into the storm drain when it rains. Have you seen a storm drain on the road near your house?"

Do

Point out the storm drain on the model to the students.

Ask

? Where would anything dumped down a storm drain end up? (In a nearby creek or river that flows to the Bay.)

Do

Point out the sink on the model to the students.

Ask

? Pollutants poured down the sink can also end up in the Bay. What happens to water that goes down the sink in our homes? (It goes to the water pollution control plant and then the treated water is emptied into the Bay, but water pollution control plants cannot remove 100% of the toxic substances; tiny amounts would go to the Bay.)

Grades K-2

Sink and Storm Drain Model (12 minutes)

Do

- Read the story book for K-2
- While the students listen and watch, choose the type of pollution that the story describes and have student volunteers pour it down the sink or the storm drain accordingly.

Ask

? How could you prevent this type of pollution from going to the Bay? (Do not dump pollutants down the storm drain, label storm drains with warnings, participate in cleanups.)

Grades 3-6

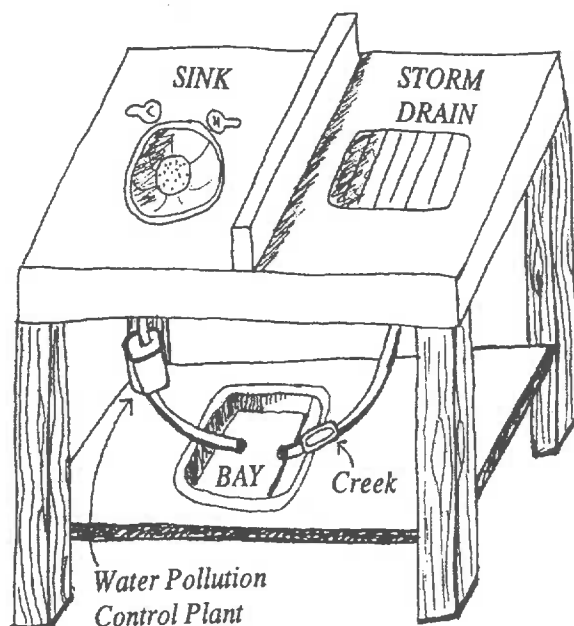
Sink and Storm Drain Model

Do

- Have the students get into pairs (two students) and hand out a product with role card attached to each pair.
- Have one pair at a time come to the front and read their story aloud to the rest of the group gathered around the model.

Ask (each pair)

? Will your pollutants (beans and rice) go down the sink or the storm drain? (Students should choose the sink or storm drain based on the information given on the card.)



Do (each pair)

The pair should pour their "pollution" into either the sink or the storm drain. Look at the container on the second shelf which represents San Francisco Bay.

Ask (each pair)

? **How could you prevent that type of pollution from entering the Bay?** (Use the answer sheet.)

Grades K-6

Discussion (3 minutes)

Ask

? **Why do you think that there is less pollution in the Bay from products that were poured down the sink versus products that were poured down the storm drain (point out the Bay in the model)?** (The water went to the water pollution control plant where it is treated and then emptied into the Bay.)

? **Is treated water that comes from the water pollution control plant 100% water?** (No. The water pollution control plant removes most of the toxic substances but some hazardous metals escape and are dumped in the bay.)

? **What happens to the solid materials that are removed from the water that is treated at the water pollution control plant?** (Items such as toilet paper, trash, plastic bags and other non-biodegradable items are removed and taken to the landfill for disposal. Biosolids aka "sludge" (human feces, food) are dried out and used as compost for crops that are not for human consumption and for covering up trash at the landfill.)

? **What happens to things we dump down the storm drain?** (They flow directly into our creeks and rivers, that flow into the Bay, without being treated at all.)

Do

Remove the center divider in the Bay.

Read

"Pollution from storm drains hurts the whole Bay."

Grades K-6

Toxic Food Pyramid (12 minutes)

Do

Show the food pyramid poster.

Ask

? **Once pollution is in the slough and Bay, it enters food pyramids, such as the one shown on this poster. What is at the base of this food pyramid?** (Plants are at the bottom of the food pyramid. They produce energy. Phytoplankton are the small, drifting plants in the slough and Bay)

? **What eats the phytoplankton in the slough and Bay?** (Zooplankton, small drifting animals.)

? **What feeds on the zooplankton?** (Mussels, clams, crabs, and other mud creatures.)

? **What feeds on the mud creatures?** (Birds.)

? **What is at the top of this food pyramid?** (Birds of prey, such as hawks and falcons)

Read

"We are going to demonstrate a food pyramid. Each of you will play a part of the food pyramid."

Do

Hand out the puppets, one per student.

(For less than 8 students, have adults participate)

8 students: 1 peregrine falcon, 1 clapper rail, 1 crab, 1 mussel, and 4 zooplankton

9 students: 1 peregrine falcon, 2 clapper rails, 1 crab, 1 mussel, and 4 zooplankton

10 students: 1 peregrine falcon, 2 clapper rails, 1 crab, 1 clam, 1 mussel, and 4 zooplankton

11 students: 1 peregrine falcon, 2 clapper rails, 1 crab, 1 clam, 1 mussel, and 5 zooplankton

12 students: 1 peregrine falcon, 2 clapper rails, 1 crab, 1 clam, 1 mussel, and 6 zooplankton

Do

Scatter a large handful of phytoplankton (green and red fuzzy balls) on the table.

Ask

? **Who feeds on the phytoplankton?** (Zooplankton.)

Do

Have the students with zooplankton puppets feed on the phytoplankton by stuffing the phytoplankton inside the zooplankton's mouths.

Read

"Besides feeding on phytoplankton, the zooplankton also fed on pollutants, which were represented by the red fuzzy balls."

Do

Hold up a bean from the sink and storm drain model and a red fuzzy ball and tell the students that these represent the same thing; pollution.

Ask

? We are going to follow the pollution up the food pyramid. Who feeds on the zooplankton? (Mud creatures and small fish.)

Do

Have the mud creatures each feed on at least one zooplankton. Have the students stuff the zooplankton inside the mud creatures. Any extra zooplankton should also be eaten by mud creatures.

Ask

? Who feeds on the mud creatures? (Birds.)

Do

Have the California clapper rail(s) feed on one mud creature. Have the students stuff the mud creatures inside the clapper rail(s') stomachs. Any extra mud creatures should then be eaten.

Ask

? Who feeds on clapper rails? (The peregrine falcon.)

Do

Have the peregrine falcon feed on the clapper rail(s). Have the students stuff the clapper rail(s) inside the peregrine falcon's stomach and zip up the stomach.

Read

"Along with feeding on everything below it, the peregrine falcon ate pollution that had built up as it went up the food pyramid. We are going to be scientists and dissect the peregrine falcon to find the pollution."

Do

With the students help, slowly take apart all of the things that the peregrine falcon has eaten.

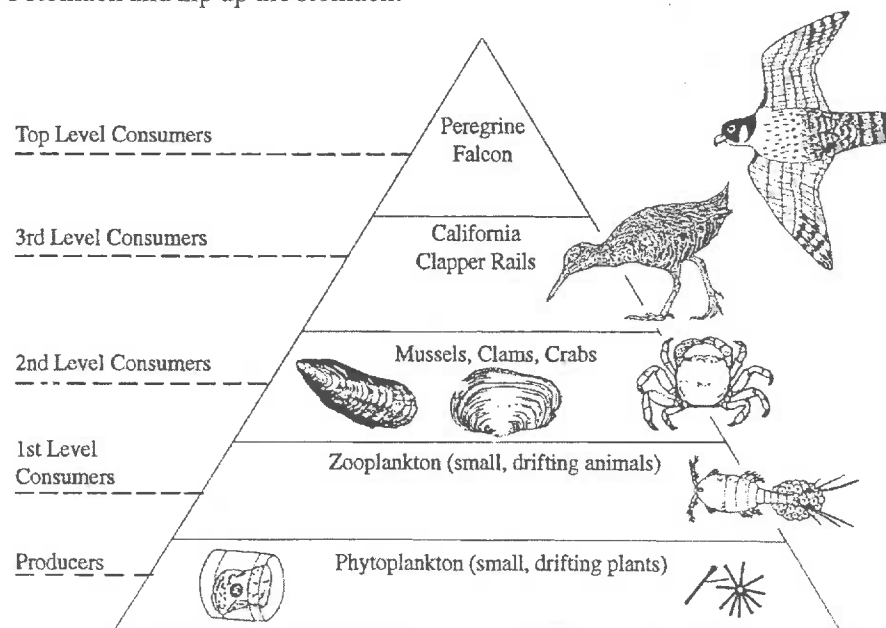
Ask

? Which animals ate the largest amount of pollution? (The ones near the top of the food pyramid: the California clapper rail and peregrine falcon.)

Read **Grades 3-6**

- "Pollution that enters the slough and Bay enters the food pyramid. Pollution travels up the food pyramid and the largest animals consume the most pollution. Consuming pollution harms the animals by making them sick.
- "For example, birds can have reduced egg shell thickness because of pollution. When they sit on their eggs, the eggs sometimes crack apart.
- "Some fish have so much pollution in them that fishermen are warned not to eat very many.

Remember: what goes down our sinks and storm drains can cause problems for wildlife and can even hurt us!"



DON'T LET YOUR POLLUTION LEAVE HOME

ANSWER SHEET FOR ROLE CARDS

# Pollutant	Sink or Storm Drain	Alternative
<i>Powdered flea soap</i>	Storm Drain	Wash pet with a citrus oil shampoo, use a flea comb or feed pets garlic tabs.
<i>Drain clog</i>	Sink	For clogs, add a handful of baking soda and 1/2 cup of white vinegar to your drain; cover tightly and let sit for 15 minutes. Then rinse with 2 quarts of boiling water; follow with a plunger. Pour boiling water down drain at least once a week to prevent buildup.
<i>Scouring powder</i>	Sink	Scrub with baking soda or a non-chlorinated scouring powder.
<i>Paint and paint thinner</i>	Storm Drain	Use latex (water-based) based paint instead of oil-based paint. Pour off clear paint thinner for reuse after particles have settled out. Take old paint and paint thinner to a hazardous waste disposal site.
<i>Laundry bleach</i>	Sink	Use Borax, a non-chlorine bleach, or hydrogen peroxide-based liquid bleaches.
<i>Car cleanser</i>	Storm Drain	Use a biodegradable soap and wash on your lawn or a dirt area so soap is filtered through soil and does not run directly to the storm drain.
<i>Oil</i>	Storm Drain	Bring used oil to a recycling center.
<i>Antifreeze</i>	Storm Drain	Be careful not to spill. Bring used antifreeze to a recycling center.
<i>Oven cleaner</i>	Sink	Mix 2 tbsp of liquid soap with 2 tsp of borax and 2 cups of warm water. Apply and let sit for 20 minutes, then scrub.
<i>Pesticide</i>	Storm Drain	Use organic farming methods, handpick pests or spray with full-force spray of water.
<i>Mildew cleaner</i>	Sink	Scrub mildew spots with a borax/water mix with a nylon scouring pad or try scrubbing with a vinegar and salt paste.